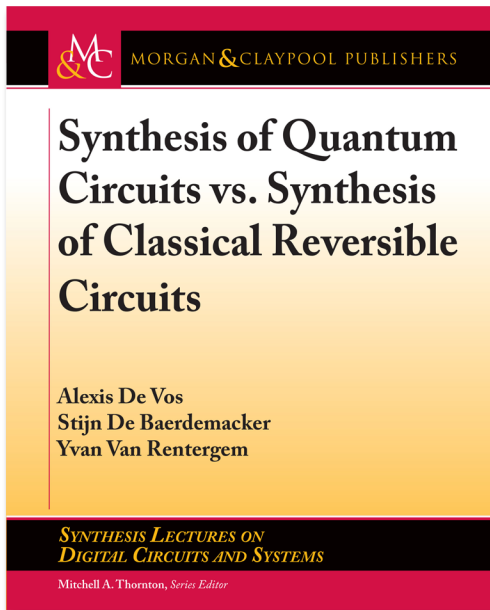


Both the synthesis of a reversible logic circuit and the synthesis of a quantum logic circuit take advantage of the decomposition of a matrix: the former of a permutation matrix, the latter of a unitary matrix. In both cases the decomposition is into three matrices. In both cases the decomposition is not unique.



## Synthesis of Quantum Circuits vs. Synthesis of Classical Reversible Circuits

Alexis De Vos, *Universiteit Gent*  
Stijn De Baerdemacker, *Universiteit Gent*  
Yvan Van Rentergem, *Universiteit Gent*

Paperback ISBN: 9781681733791 • eBook ISBN: 9781681733807  
Hardcover ISBN: 9781681733814 • July, 2018 • 125 pages  
Paperback: \$54.95 • eBook: \$43.96 • Combo: \$68.69  
Hardcover: \$74.95 • Hardcover Combo: \$93.69

At first sight, quantum computing is completely different from classical computing. Nevertheless, a link is provided by reversible computation.

Whereas an arbitrary quantum circuit, acting on  $w$  qubits, is described by an  $n \times n$  unitary matrix with  $n=2^w$ , a reversible classical circuit, acting on  $w$  bits, is described by a  $2^w \times 2^w$  permutation matrix. The permutation matrices are studied in group theory of finite groups (in particular the symmetric group  $\mathcal{S}_n$ ); the unitary matrices are discussed in group theory of continuous groups (a.k.a. Lie groups, in particular the unitary group  $U(n)$ ).

Both the synthesis of a reversible logic circuit and the synthesis of a quantum logic circuit take advantage of the decomposition of a matrix: the former of a permutation matrix, the latter of a unitary matrix. In both cases the decomposition is into three matrices. In both cases the decomposition is not unique.

### CONTENTS

- Introduction
- Bottom
- Bottom-Up
- Top
- Top-Down
- Conclusion
- Bibliography
- Authors' Biographies
- Index



MORGAN & CLAYPOOL  
PUBLISHERS

[www.morganclaypoolpublishers.com](http://www.morganclaypoolpublishers.com)  
[info@morganclaypool.com](mailto:info@morganclaypool.com)

Find Print, eBooks, and check for  
Institutional Access all in one place.

Print & eBooks at <http://store.morganclaypool.com>